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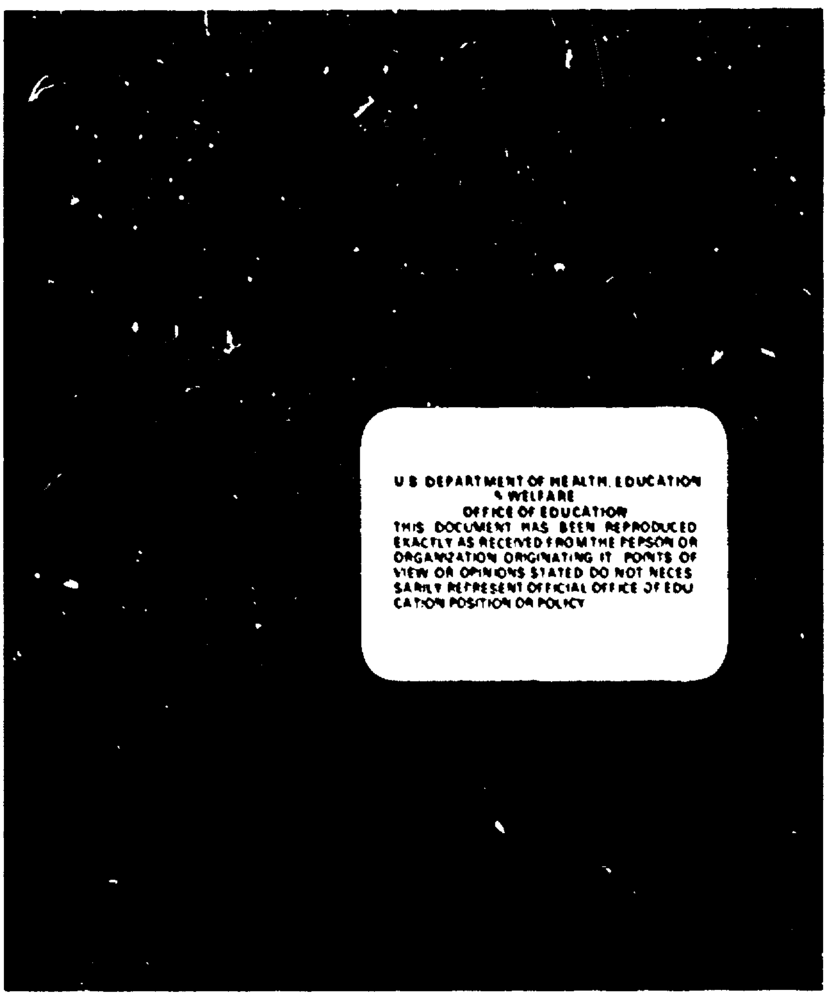
ABSTRACT

This document, Part II of a two-part study, is the summary chapter of a report which sought to ascertain the relationship of grade level, achievement level, sex, and method of presentation to the various bases by which children classify geometric concepts. Two tasks, administered consecutively to 96 subjects in grades five, eight, and eleven, consisted of the sequential presentation of an array of eight geometric concept cards (Task I), and a 26-item picture array of geometric concept instances presented simultaneously (Task II). The summary and implications of the research are presented in this volume, along with appendices which pertain to: materials; instructions to students; initial response data for Task I and Task II; and means and standard deviations for total response analyses of Task I and Task II. A reference list is also included. For the first portion of the report, see CG 006 140. (Author/CJ)



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Technical Report No. 143   Part II (of 2 Parts)

BASES OF CLASSIFICATION OF GEOMETRIC CONCEPTS USED BY CHILDREN OF VARYING CHARACTERISTICS

Report from the Project on
Situational Variables and Efficiency of
Concept Learning

By Suzanne Pasch Wiviott

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Madison, Wisconsin

Octcber, 1970

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The Wisconsin Research and Development Center for Cognitive Learning focuses on contributing to a better understanding of cognitive learning by children and youth and to the improvement of related educational practices. The strategy for research and development is comprehensive. It includes basic research to generate new knowledge about the conditions and processes of learning and about the processes of instruction, and the subsequent development of research-based instructional materials, many of which are designed for use by teachers and others for use by students. These materials are tested and refined in school settings. Throughout these operations behavioral scientists, curriculum experts, academic scholars, and school people interact, insuring that the results of Center activities are based soundly on knowledge of subject matter and cognitive learning and that they are applied to the improvement of educational practice.

This technical report is from the Situational Variables and Efficiency of Concept Learning Project in Program 1. General objectives of the Program are to generate new knowledge about concept learning and cognitive skills, to synthesize existing knowledge, and to develop educational materials suggested by the prior activities. Contributing to these Program objectives, the Concept Learning Project has the following five objectives: to identify the conditions that facilitate concept learning in the school setting and to describe their management, to develop and validate a schema for evaluating the student's level of concept understanding, to develop and validate a model of cognitive processes in concept learning, to generate knowledge concerning the semantic components of concept learning, and to identify conditions associated with motivation for school learning and to describe their management.

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Finally, while it may not be customary, I would nonetheless like to express my deep-felt appreciation to my family. To my parents, Mr. and Mrs. Nathan F. Pasch, who instilled within me a curiosity and love for learning, and my parents-in-law, Mr. and Mrs. Samuel I. Wiviott, who gave of their time and effort to assist me in so many ways in finishing this thesis, thanks for your understanding, love, and tolerance.

To my children, Lori and Stephen, who were too young to really understand my work and why I was so busy with it, thanks for serving as a major impetus for finishing it.

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ABSTRACT

The purpose of this experiment was to ascertain the relationship of grade level, achievement level, sex, and method of presentation to the various bases by which children classify geometric concepts.

Two tasks were administered consecutively to 96 subjects in the fifth-, eighth-, and eleventh grades, 32 at each grade level. The subjects were randomly selected from groups stratified according to sex and mathematical achievement level and then randomly assigned to either the verbal or pictorial treatment group for the first task.

Task I consisted of the sequential presentation of an array of eight geometric concept cards. The concepts were progressively more diverse and the final concept was a contrast class. The array consisted of square, rectangle, rhombus, parallelogram, quadrilateral, triangle, circle, and cube. The subjects were presented with the first two items and asked how they were alike. The third item was then presented and the subjects asked how it differed from the first two and then how all three were alike. The procedure was continued until all the items except "cube" had been included in a similarity formation. Half the subjects saw cards with the concept name printed on them; the remaining half saw cards with the concept instance printed on them.

In the second task, a 26-item picture array of geometric concept instances was simultaneously presented. The concepts were those used in Task I although the contrast item, "cube," was eliminated. Instances of the seven geometric concepts were varied along the irrelevant attributes of size and orientation. The subjects were asked to form a group of instances that were alike and then explain how they were alike. The instances were replaced in the array and the procedure continued until seven different groups had been formed.

Responses given by subjects on Task I were categorized according to four bases of classification: Perceptible, Attribute, Nominal, and Subject-Fiat. Responses given by subjects on Task II were categorized according to three bases of classification: Perceptible, Attribute, and Nominal. The essential findings were:

1. An increase in grade level was accompanied by a decrease in the use of the Perceptible basis of classification and an increase in the attribute and nominal bases of classification. Thus, the development of classificatory behavior proceeds with age and experience from reliance on perceptual cues toward the use of intrinsic properties.

2. High achievers at all grade levels used the Perceptible category less and the Attribute and Nominal categories more than low achievers. High achievers thus appear to develop more rapidly the ability to classify by means of intrinsic characteristics.

3. Boys and girls did not differ significantly in their bases of classifying geometric figures.

4. Subjects who were presented with pictorial stimuli gave more Perceptible responses than subjects who were presented with verbal stimuli on Task I. There also appeared to be a tendency for subjects who had received words as stimuli on Task I to give more Nominal responses on Task II than subjects who had received pictures as stimuli on Task I.

Chapter V

SUMMARY AND IMPLICATIONS

Summary

The purpose of this study was to ascertain the relationship of grade level, achievement level, sex, and method of presentation to the various bases by which students classify geometric figures. The study had the objective of answering the following questions:

1. Do children in grades 5, 8, and 11 differ in their bases of classifying geometric figures?
2. Do children of high and low achievement differ in their bases of classifying geometric figures?
3. Do boys and girls differ in their bases of classifying geometric figures?
4. Does a verbal or pictorial method of presentation affect the bases of classifying geometric figures?
5. Does the degree of correctness of the responses differ between grade levels, achievement levels, sexes, and methods of presentation?

Two classification tasks were administered to 96 Ss, stratified according to grade level, mathematical achievement level, and sex, and randomly assigned to pictorial and verbal treatment groups.

The basic design of the experiment was a 3 x 2 x 2 x 2 factorial design with three grade levels, and two levels of achievement, sex, and method of presentation. This resulted in twenty-four treatment conditions with four Ss in each cell.

The first task consisted of a fixed-order, sequential presentation of cards. Half the Ss were shown cards with geometric concept instances printed on them; the remaining half were shown cards with geometric concept names printed on them. Subjects were asked to explain how the cards were similar to and how they were different from each other. They were asked to make six similarity and six difference judgments. The geometric concepts which composed the array were: square, rectangle, rhombus, parallelogram, quadrilateral, triangle, circle, and cube, with the final item forming a contrast class.

The second task consisted of a free-sort of twenty-six geometric concept cards presented pictorially. The concepts were those used in the first task, with the exception of the contrast class item. Instances were varied along the irrelevant attribute dimensions of size and orientation. Subjects were asked to form groups of pictures they thought belonged together and then to explain their basis for classifying them. A total of seven sorts was made by each S.

The bases of classification used to score Task I responses were Perceptible, Attribute, Nominal, and Subject-Fiat categories; for Task II responses, Perceptible, Attribute, and Nominal categories were used. Multivariate analyses of variance on the number of initial responses in each classification category were carried out for Task I and Task II. A univariate analysis of variance on the number of Subject-Fiat responses was carried out to determine if differences existed between the similarity and difference subtasks of Task I.

To determine whether there were differences in the percentage of correct responses given as a function of grade level, achievement level, sex, and method of presentation, univariate analyses of variance were carried out on the percentage of correct responses for Task I and Task II.

With regard to the questions posed at the outset of the study, the essential findings of the study were:

1. Grade Level - On both tasks, grade level had a significant effect on bases of classification. An increase in grade level was accompanied by a decrease in the use of the Perceptible basis of classification and an increase in the use of the Attribute and Nominal bases. Thus, children in grades 5, 8, and 11 do differ in their bases of classifying geometric figures, as older children rely less on lower-order and more on higher-order bases of classification, with the greatest change occurring between grades 5 and 8.

2. Achievement Level - On both tasks, achievement level had a significant effect on bases of classification. High achievers used fewer Perceptible and more Attribute and Nominal bases of classification than low achievers. In Task I, a significant interaction between grade and achievement indicated that low-achieving eighth-grade Ss perform similarly to high-achieving fifth-grade Ss while high-achieving eighth-grade Ss most closely resemble low-achieving eleventh-grade Ss. Therefore, children of high and low mathematical achievement levels do differ in their bases of classifying geometric figures, with high-achieving Ss developing more rapidly the ability to classify by means of higher-order bases of classification.
3. Sex - Sex did not have a significant effect on bases of classification for either task.
4. Method of Presentation - On Task I, method of presentation had a significant effect on bases of classification. Subjects who were presented with pictorial stimuli used more perceptible responses than Ss who were presented with verbal stimuli. On Task II, the initial response analysis did not indicate a significant treatment effect. When total responses were considered, though, it appeared that Ss who had received words as stimuli on Task I gave more nominal

responses on Task II than Ss who had received pictures as stimuli on Task I. Thus, method of presentation did affect the bases of classifying geometric figures in that pictorial symbols elicited more perceptible responses than verbal stimuli. There also appears to be a trend whereby assignment to the verbal treatment group on Task I affects the number of nominal responses given on Task II.

5. Percentage of Correct Responses - On Task I, the percentage of correct responses was affected only by the achievement level, with high achievers giving more correct responses than low achievers. No significant differences were found in the analysis of incidence of percentage of correct responses for Task II. All groups had a high percentage of correct responses, so that, although the trend was for percentage of correct responses to increase with increasing grade, the differences were not significant. Thus, the percentage of correct responses differed only with achievement level and only on the fixed-order, sequential presentation task.

Implications

The basic finding of this study was that the growth of classificatory behavior proceeds in an orderly manner from reliance on perceptual bases of classification toward the ability to classify objects on the bases of intrinsic properties as a function of age. This replicated the findings of Olver and Rigney (Bruner, et al., 1966), when geometric figures were used as materials. Apparently, the ability of school children to classify geometric concepts on the bases of intrinsic properties is an ability which increases with increasing age. This finding implies that the teaching of concepts to school children should probably be based on the level of attainment they have reached and concepts should be presented to them in terms of the bases of classification they are able to use.

The predominance of achievement level as a significant variable in determining the bases of classification of geometric figures suggests that factors other than chronological age might reflect the current level of the development of classificatory behavior in school children. It was suggested earlier in this paper that one possible implication of the study might be to find ways of implementing a program for accelerating the level of cognitive development in children.

The significant interaction of grade with achievement on Task I and the significant effect of achievement level as a variable on both tasks suggests that there are groups of children within the chronological age divisions who behave very differently from each other in selecting bases of classification. The implication of the significant results of grade level and achievement level appears to be that while children move gradually as a function of age from a reliance on perceptual cues to an application of intrinsic properties when classifying objects, there is a great variation in the behavior of children within each of these grade levels.

Since in this study the children in the two achievement level groups were not exposed to different instruction, it seems that one index to assess the degree of variation within grade levels is achievement level. By using both grade level and achievement level to assess the level of cognitive development in children, one might be better able to indicate which children could profit from a program of limited acceleration. The results of this study seem to imply that the low-achieving eighth- and eleventh-grade Ss, who have reached the chronological level where they are beginning to classify objects on the bases of their intrinsic properties, but who have apparently not learned the techniques of classifying objects by means of defining their attributes or placing them in hierarchical order as effectively as their high-achieving classmates would be the students to identify for the program of acceleration.

In addition to identifying Ss who could profit from a program of acceleration, the study seems to hold implications for the manner in which this program could be implemented. It was found that pictorial stimuli elicit a greater number of perceptible responses. There was also a trend whereby children who had been shown concept names had a tendency to classify objects according to a nominal hierarchy. It was also noted that a free-sort task tended to elicit greater reliance on the nominal basis of classification. Further research is needed to clarify the effects of type of task and method of presentation of stimuli on the bases of classification, but it is possible that manipulation of these variables might be helpful in developing the material to be used in an acceleration program.

Thus, the most important implications of this study for education seem to be that the growth of this cognitive skill proceeds in an orderly direction as a function of age, that there are groups of students at each grade level tested who have not attained the level of development exhibited by other students in their age range, and that the level of cognitive development of these students might be accelerated by a program of instruction. Such a program could utilize the tasks and methods of presentation of stimuli which have been shown to increase specific bases of classification.

APPENDIX A

MATERIALS

TASK I

Pictorial Treatment Group

The experimental materials consisted of eight, 4"x 6" white cards, each of which had a picture of a geometric concept printed on it in black ink. The geometric concepts utilized in order of presentation were: square, rectangle, rhombus, parallelogram, quadrilateral, triangle, circle, and cube. The cards used in Task I, Treatment 1 are illustrated on the following page.

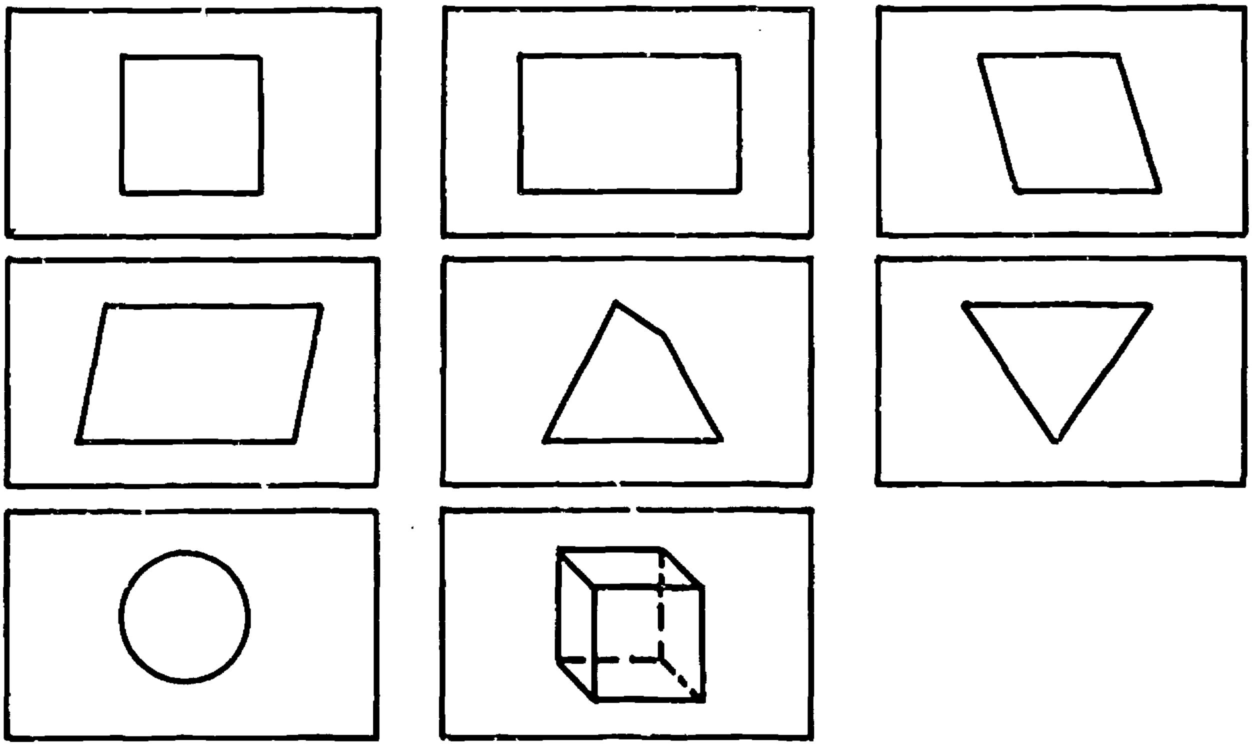
Verbal Treatment Group

The names of the eight geometric concepts used in the pictorial treatment group were printed in black ink on 4"x 6" white cards. The cards for Task I, Treatment 2 are illustrated on the following page.

TASK II

The materials for Task II consisted of 4"x 6"white cards, each of which had a picture of a geometric concept printed on it in black ink. The geometric concepts were: square, rectangle, rhombus, parallelogram, quadrilateral, triangle, and circle. The instances were varied systematically according to the irrelevant attributes of size and orientation (left vs. right, or up vs. down). The resulting array of 26 cards is illustrated as it appeared to the Ss on page 115.

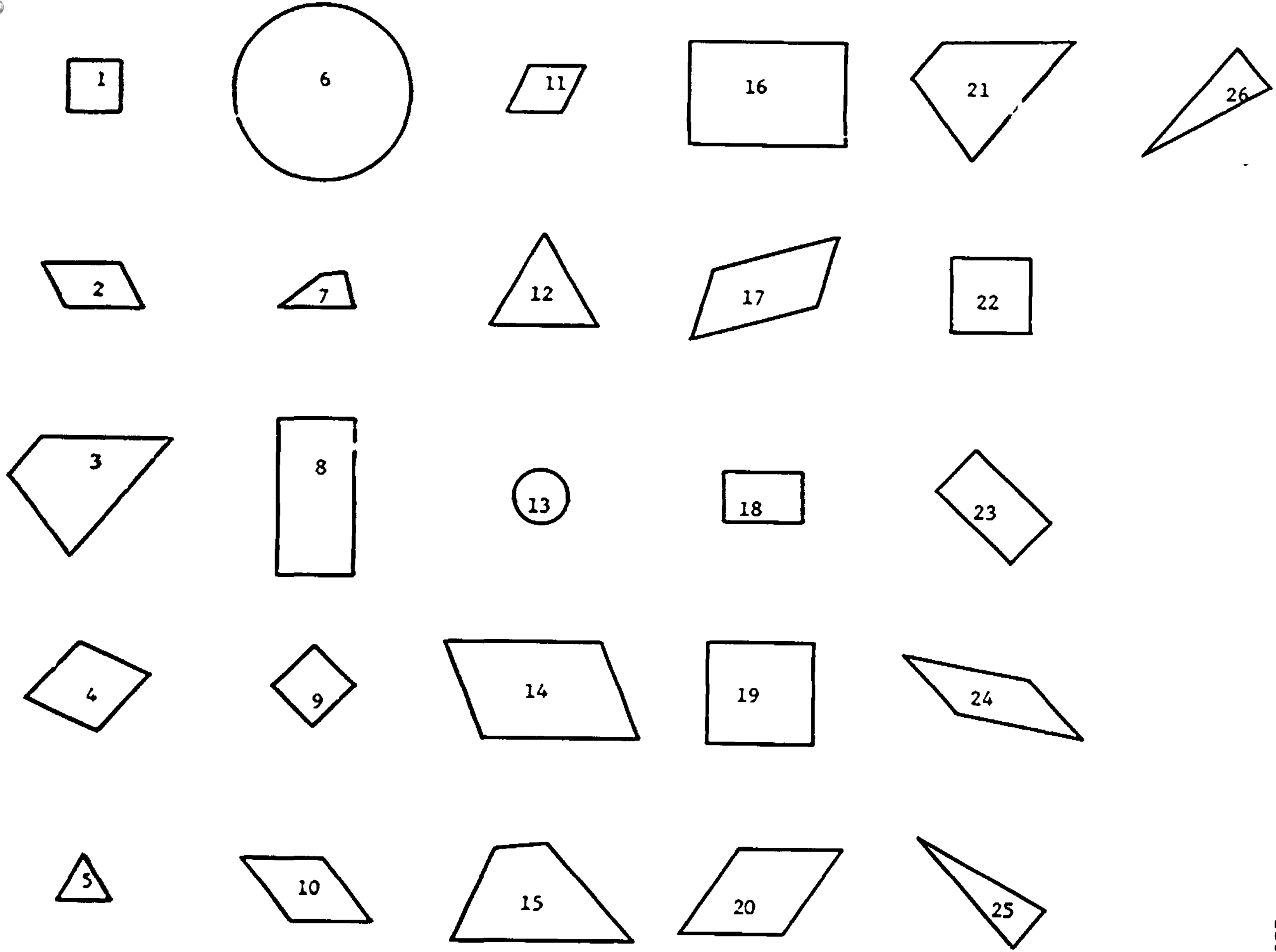
TASK I, PICTORIAL TREATMENT



TASK I, VERBAL TREATMENT

SQUARE	RECTANGLE	RHOMBUS
PARALLELOGRAM	QUADRILATERAL	TRIANGLE
CIRCLE	CUBE	

TASK II STIMULI



APPENDIX B

INSTRUCTIONS TO STUDENTS

INSTRUCTIONS

Task I

Pictorial Treatment Group

I am going to show you some white cards with pictures on them. As I show you the cards, I will ask you to tell me either how they are alike, or how they are different from each other. I want you to tell me as many reasons as you can think of.

Verbal Treatment Group

I am going to show you some white cards with words printed on them. I will pronounce the words for you and you can repeat them after me. (pause)

As I show you the cards, I will ask you to tell me either how they are alike or how they are different from each other.

I want you to tell me as many reasons as you can think of.

Task II

I am going to show you a group of pictures. I want you to look at all the pictures first. (pause) I want you to select from this group some pictures that are alike in some way--any way at all in which a group of things is alike--and remove them from the group. You may take as few or as many pictures as you like. (Student then selects his group of pictures.)

Now, tell me how these pictures are alike.

APPENDIX C

INITIAL RESPONSE DATA FOR TASK I AND TASK II

Task I - Initial Response Data

Treatment Group	S Like	P Like	A Like	N Like	S Like	P Diff	A Diff	N Diff	S Diff	% of total correct responses
Grade 5	1	1	5	0	0	3	2	1	0	100%
High	2	5	0	0	1	4	0	0	2	85.71%
Male	3	0	2	4	0	1	4	0	1	100%
Pictorial	4	0	4	2	0	3	2	0	1	92%
Grade 5	5	0	3	3	0	3	2	0	1	100%
High	6	1	5	0	0	1	4	0	1	95.45%
Male	7	5	0	0	1	3	2	0	[illegible]	80%
Verbal	8	0	4	2	0	2	2	0	2	100%
Grade 5	9	1	5	0	0	2	2	0	2	100%
High	10	0	4	0	2	4	2	0	0	89.47%
Female	11	2	3	1	0	2	4	0	0	100%
Pictorial	12	0	6	0	0	2	4	0	0	92.85%
Grade 5	13	0	4	2	0	1	4	0	1	76.47%
High	14	0	3	0	3	1	3	0	2	100%
Female	15	1	3	2	0	1	3	0	2	96.55%
Verbal	16	0	1	4	1	1	2	0	3	100%
Grade 5	17	1	4	0	1	3	3	0	0	91.[illegible]%
Low	18	0	6	0	0	3	2	0	1	100%
Male	19	4	2	0	0	4	1	0	1	100%
Pictorial	20	2	1	1	2	3	0	0	3	64.28%

Treatment Group	S Like	P Like	A Like	N Like	S Like	P Diff	A Diff	N Diff	S Diff	% of total correct responses
Grade 5	21	1	4	1	0	0	5	0	1	90.9%
Low	22	0	4	2	0	1	3	0	2	85.71%
Male	23	1	2	3	0	1	4	0	1	87.5%
Verbal	24	0	5	1	0	3	2	0	1	95.8%
Grade 5	25	2	3	0	1	4	2	0	0	82.35%
Low	26	0	4	1	1	1	4	0	1	93.33%
Female	27	5	0	1	0	3	3	0	0	86.66%
Pictorial	28	0	4	2	0	3	3	0	0	81.81%
Grade 5	29	0	1	0	5	2	2	0	2	85.71%
Low	30	0	6	0	0	3	2	0	1	100%
Female	31	0	3	0	3	0	2	0	4	88.23%
Verbal	32	0	3	0	3	1	3	0	2	76.47%
Grade 8	33	6	0	0	0	3	2	0	1	88.88%
High	34	4	2	0	0	2	3	0	1	95.45%
Male	35	1	2	0	3	0	5	0	1	100%
Pictorial	36	4	1	0	1	3	2	0	1	100%
Grade 8	37	0	3	3	0	0	5	1	0	100%
High	38	0	6	0	0	0	5	0	1	95.65%
Male	39	1	4	0	1	1	3	0	2	95.23%
Verbal	40	0	6	0	0	0	6	0	0	100%

Treatment Group	S Like	P Like	A Like	N Like	S Like	P Diff	A Diff	N Diff	S Diff	% of total correct responses
Grade 8	41	0	5	0	1	2	4	0	0	100%
High	42	0	5	1	0	0	6	0	0	100%
Female	43	0	6	0	0	1	5	0	0	94.73%
Pictorial	44	0	6	0	0	0	6	0	0	100%
Grade 8	45	0	6	0	0	0	3	0	3	100%
High	46	1	5	0	0	0	6	0	0	97.36%
Female	47	0	6	0	0	0	4	0	2	91.3%
Verbal	48	0	6	2	0	0	4	0	2	100%
Grade 8	49	5	0	0	1	2	1	0	3	83.33%
Low	50	0	4	2	0	2	4	0	0	89.47%
Male	51	0	3	2	1	2	3	1	0	100%
Pictorial	52	1	5	0	0	3	3	0	0	100%
Grade 8	53	1	4	0	1	2	2	0	2	95%
Low	54	0	0	5	1	2	1	0	3	83.33%
Male	55	0	3	2	1	0	4	0	2	89.47%
Verbal	56	1	2	2	1	0	4	0	2	80%

Treatment Group	S Like	P Like	A Like	N Like	S Like	P Diff	A Diff	N Diff	S Diff	% of total correct responses
Grade 8	57	1	1	3	1	2	4	0	0	88.46%
Low	58	0	5	0	1	3	3	0	0	100%
Female	59	0	6	0	0	6	0	0	2	100%
Pictorial	60	2	3	0	1	6	0	0	2	100%
Grade 8	61	0	3	0	3	1	4	0	1	78.57%
Low	62	1	2	1	2	1	3	0	2	80%
Female	63	0	4	0	2	3	1	0	2	100%
Verbal	64	0	1	5	0	2	3	0	1	80%
Grade 11	65	2	3	0	1	3	3	0	0	100%
High	66	0	4	2	0	0	5	1	0	100%
Male	67	2	4	0	0	1	3	1	1	100%
Pictorial	68	0	4	2	0	0	6	0	0	100%
Grade 11	69	0	4	2	0	0	6	0	0	100%
High	70	0	4	2	0	0	6	0	0	100%
Male	71	0	5	1	0	0	5	1	0	100%
Verbal	72	0	1	5	0	0	6	0	0	84.21%
Grade 11	73	1	5	0	0	3	3	0	0	100%
High	74	0	6	2	0	0	5	1	0	100%
Female	75	0	2	4	0	0	6	0	0	100%
Pictorial	76	0	6	0	2	0	6	0	0	100%

Treatment Group	S Like	P Like	A Like	N Like	S Like	P Diff	A Diff	N Diff	S Diff	% of total correct responses
Grade 11	77	0	1	5	0	0	4	1	1	92.85%
High	78	0	6	2	0	1	5	0	0	95%
Female	79	0	1	4	1	2	3	0	1	90%
Verbal	80	1	3	2	0	0	6	0	0	100%
Grade 11	81	0	2	4	0	0	2	0	4	95.45%
Low	82	3	0	0	3	3	1	0	2	96%
Male	83	0	3	3	0	0	5	1	0	100%
Pictorial	84	0	4	1	1	2	4	0	0	100%
Grade 11	85	0	6	0	0	0	4	0	2	83.33%
Low	86	0	6	0	0	1	2	0	3	88.88%
Male	87	0	6	0	0	2	2	0	2	90%
Verbal	88	0	3	0	3	2	3	0	1	93.75%
Grade 11	89	0	4	2	0	3	3	0	0	100%
Low	90	0	4	1	1	1	2	1	2	88%
Female	91	3	0	3	0	3	3	0	0	76.47%
Pictorial	92	0	6	0	0	3	3	0	0	95.45%
Grade 11	93	0	4	0	2	2	2	0	2	100%
Low	94	0	3	1	2	1	3	0	2	96%
Female	95	0	6	0	0	0	5	0	1	88.88%
Verbal	96	0	4	0	2	0	4	0	2	87.50%

Task II - Initial Response Data

Identification	S	P	A	N	% of total correct responses
Grade 5	1	3	1	3	100%
High	2	7	0	0	66.66%
Male	3	1	1	5	100%
Pictorial	4	2	0	5	87.50%
Grade 5	5	0	1	6	92.30%
High	6	1	3	3	100%
Male	7	2	0	5	87.50%
Verbal	8	0	5	2	100%
Grade 5	9	2	2	4	100%
High	10	2	2	3	100%
Female	11	1	0	6	100%
Pictorial	12	0	3	4	80%
Grade 5	13	2	1	4	83.33%
High	14	0	3	4	100%
Female	15	4	0	3	88.88%
Verbal	16	5	0	2	100%
Grade 5	17	3	2	2	87.50%
Low	18	5	2	0	100%
Male	19	0	3	4	100%
Pictorial	20	4	0	3	71.42%
Grade	21	2	3	2	100%
Low	22	1	1	5	62.50%
Male	23	2	2	3	87.50%
Verbal	24	1	0	6	70%
Grade 5	25	4	0	3	81.81%
Low	26	2	0	5	100%
Female	27	1	6	0	100%
Pictorial	28	6	2	1	87.50%

Identification	S	P	A	N	% of total correct responses
Grade 5	29	5	2	0	88.88%
Low	30	0	1	6	100%
Female	31	7	0	0	70%
Verbal	32	2	3	2	100%
Grade 8	33	0	1	6	88.88%
High	34	0	1	6	85.71%
Male	35	1	2	4	100%
Pictorial	36	4	0	3	100%
Grade 8	37	0	0	7	100%
High	38	0	1	6	87.50%
Male	39	0	0	7	100%
Verbal	40	0	5	2	100%
Grade 8	41	0	3	4	100%
High	42	0	6	1	100%
Female	43	0	3	4	100%
Pictorial	44	0	2	5	90%
Grade 8	45	0	1	6	76.92%
High	46	1	0	6	85.71%
Female	47	0	1	6	90.70%
Verbal	48	0	0	7	100%
Grade 8	49	5	0	2	85.71%
Low	50	1	4	2	100%
Male	51	1	2	4	100%
Pictorial	52	1	5	1	100%
Grade 8	53	3	0	4	85.71%
Low	54	5	0	2	100%
Male	55	2	0	5	85.71%
Verbal	56	5	0	2	100%
Grade 8	57	2	0	5	100%
Low	58	2	1	4	85.71%
Female	59	5	0	2	100%
Pictorial	60	3	0	4	85.71%

Identification	S	P	A	N	% of total correct responses
Grade 8	61	3	0	4	100%
Low	62	1	0	6	75%
Female	63	2	1	4	56.14%
Verbal	64	3	1	3	100%
Grade 11	65	1	2	4	90%
High	66	0	3	4	100%
Male	67	1	1	5	100%
Pictorial	68	0	6	1	100%
Grade 11	69	0	0	7	100%
High	70	1	0	6	100%
Male	71	0	0	7	100%
Verbal	72	0	2	5	100%
Grade 11	73	3	3	1	100%
High	74	0	1	6	100%
Female	75	0	0	7	100%
Pictorial	76	1	1	5	100%
Grade 11	77	1	2	4	90%
High	78	0	0	7	100%
Female	79	1	0	6	90%
Verbal	80	0	0	7	100%
Grade 11	81	0	0	7	100%
Low	82	3	0	4	100%
Male	83	0	1	6	100%
Pictorial	84	0	0	7	85.71%
Grade 11	85	0	1	6	87.50%
Low	86	3	0	4	75%
Male	87	1	2	4	100%
Verbal	88	3	3	1	92.30%
Grade 11	89	0	2	5	100%
Low	90	3	0	4	85.71%
Female	91	3	1	3	100%
Pictorial	92	3	1	3	85.71%

Identification	S	P	A	N	% of total correct responses
Grade 11	93	0	3	4	100%
Low	94	1	2	4	100%
Female	95	0	3	4	100%
Verbal	96	0	0	7	100%

APPENDIX D

MEANS AND STANDARD DEVIATIONS FOR

TOTAL RESPONSE ANALYSES OF TASK I AND TASK II

TASK I

Grade 5	P Diff	A Diff	N Diff	S Diff	P Like	A Like	N Like	S Like
HM-P	.46 (.22)	.37 (.27)	.01 (.03)	.14 (.06)	.31 (.31)	.42 (.28)	.18 (.24)	.09 (.13)
HM-V	.32 (.14)	.52 (.11)	0 (0)	.16 (.08)	.21 (.36)	.59 (.35)	.15 (.21)	.05 (.06)
HF-P	.41 (.18)	.45 (.17)	.04 (.04)	.08 (.09)	.18 (.09)	.68 (.25)	.09 (.18)	.05 (.10)
HF-V	.20 (.08)	.52 (.09)	0 (0)	.27 (.02)	.22 (.19)	.39 (.15)	.28 (.15)	.11 (.16)
LM-P	.50 (.14)	.19 (.15)	.02 (.04)	.28 (.23)	.32 (.25)	.49 (.34)	.07 (.14)	.12 (.14)
LM-V	.31 (.10)	.51 (.10)	.02 (.04)	.15 (.06)	.16 (.18)	.63 (.28)	.21 (.10)	0 (0)
LF-P	.49 (.19)	.41 (.22)	0 (0)	.10 (.08)	.33 (.31)	.48 (.25)	.12 (.08)	.07 (.08)
LF-V	.29 (.11)	.42 (.09)	0 (0)	.29 (.20)	0 (0)	.51 (.36)	0 (0)	.49 (.36)
Grade Mean	.37	.42	.01	.19	.22	.52	.14	.12

NOTE. - Standard Deviations are given in parentheses

TASK I

Grade 8	P Diff	A Diff	N Diff	S Diff	P Like	A Like	N Like	S Like
HM-P	.44 (.24)	.43 (.25)	0 (0)	.12 (.06)	.61 (.31)	.25 (.18)	0 (0)	.13 (.18)
HM-V	.04 (.09)	.85 (.15)	.02 (.05)	.08 (.09)	.05 (.06)	.81 (.13)	.11 (.17)	.02 (.05)
HF-P	.06 (.07)	.91 (.06)	.02 (0)	.02 (.05)	.07 (.10)	.86 (.06)	.03 (.04)	.02 (.05)
HF-V	.05 (.06)	.76 (.12)	.02 (.04)	.16 (.11)	.04 (.09)	.86 (.08)	.09 (.07)	0 (0)
LM-P	.56 (.13)	.37 (.19)	.02 (.04)	.05 (.10)	.34 (.33)	.43 (.22)	.16 (.21)	.05 (.06)
LM-V	.27 (.17)	.43 (.22)	0 (0)	.30 (.07)	.18 (.18)	.30 (.22)	.39 (.21)	.12 (.02)
LF-P	.49 (.16)	.35 (.34)	0 (0)	.16 (.19)	.26 (.15)	.55 (.29)	.08 (.17)	.10 (.07)
LF-V	.33 (.18)	.36 (.15)	0 (0)	.30 (.08)	.07 (.08)	.43 (.24)	.21 (.34)	.29 (.21)
Grade Mean	.28	.56	.08	.15	.20	.56	.14	.09

NOTE. - Standard Deviations are given in parentheses

TASK I

Grade 11	P Diff	A Diff	N Diff	S Diff	P Like	A Like	N Like	S Like
HM-P	.22 (.22)	.70 (.22)	.07 (.08)	.01 (.02)	.28 (.24)	.51 (.28)	.12 (.11)	.09 (.19)
HM-V	0 (0)	.97 (.05)	.02 (.05)	0 (0)	0 (0)	.53 (.21)	.47 (.21)	0 (0)
HF-P	.15 (.14)	.02 (.11)	.02 (.05)	0 (0)	.27 (.27)	.50 (.30)	.19 (.18)	.03 (.07)
HF-V	.16 (.24)	.77 (.26)	.02 (.04)	.05 (.12)	.05 (.35)	.56 (.32)	.37 (.26)	.02 (.14)
LM-P	.21 (.31)	.57 (.26)	.06 (.04)	.16 (.12)	.17 (.35)	.44 (.32)	.28 (.26)	.10 (.14)
LM-V	.14 (.17)	.67 (.15)	0 (0)	.18 (.08)	.05 (.10)	.79 (.21)	0 (0)	.16 (.23)
LF-P	.30 (.13)	.61 (.09)	.02 (.03)	.07 (.09)	.14 (.16)	.59 (.25)	.23 (.13)	.02 (.05)
LF-V	.08 (.12)	.61 (.23)	0 (0)	.31 (.14)	0 (0)	.69 (.02)	.12 (.09)	.19 (.08)
Grade Mean	.16	.72	.02	.06	.12	.50	.22	.08

NOTE. - Standard Deviations are given in parentheses

TASK II

	PICTORIAL			VERBAL		
Grade 5	P	A	N	P	A	N
HM	.44 (.30)	.25 (.07)	.31 (.24)	.10 (.10)	.49 (.36)	.40 (.27)
HF	.16 (.18)	.35 (.28)	.49 (.26)	.41 (.30)	.18 (.19)	.40 (.12)
LM	.44 (.33)	.22 (.20)	.34 (.24)	.25 (.11)	.27 (.08)	.47 (.16)
LF	.38 (.15)	.37 (.13)	.25 (.14)	.45 (.36)	.20 (.10)	.35 (.37)
Grade Mean	.35	.30	.35	.30	.29	.41
Grade 8 HM	.21 (.25)	.16 (.12)	.63 (.18)	.03 (.06)	.23 (.38)	.74 (.38)
HF	.10 (.02)	.44 (.28)	.46 (.23)	.09 (.11)	.17 (.1)	.74 (.24)
LM	.29 (.28)	.36 (.27)	.35 (.16)	.58 (.25)	0 (0)	.42 (.25)
LF	.45 (.17)	.04 (.07)	.51 (.15)	.33 (.16)	.10 (.06)	.57 (.15)
Grade Mean	.26	.22	.49	.26	.12	.62
Grade 11 HM	.08 (.10)	.44 (.29)	.48 (.24)	.03 (.07)	.07 (.14)	.89 (.14)
HF	.17 (.22)	.20 (.19)	.63 (.39)	.07 (.09)	.07 (.15)	.85 (.19)
LM	.10 (.21)	.08 (.17)	.81 (.22)	.27 (.20)	.27 (.14)	.46 (.28)
LF	.31 (.16)	.23 (.19)	.46 (.09)	.01 (.03)	.36 (.27)	.62 (.27)
Grade Mean	.17	.24	.59	.09	.17	.71

NOTE. - Standard Deviations are given in parentheses

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